digital
146 Main Street
Maynard, Massachusetts 01754

edu

Number 6

CARNEGIE COMMISSION SEES " TECHNOLOGICAL REVOLUTION" IN HIGHER EDUCATION

Higher education "now faces the first great technological revolution in five centuries." So says the Carnegie Commission on Higher Education, according to a recent article in the New York Times (6/2/72). The Commission expects "such instructional tools as . . . computers to be in general use by the year 2,000 . . . and the sooner the better!"

The Commission recommended that the Federal Government spend from $100 million to $300 million a year over the next seven years to promote the development and spread of the "new technology" of instruction. It urged the establishment of seven regional centers to develop and disseminate materials and techniques for the new media. The centers would be established at the rate of one every three years between 1973 and 1992 in Boston, Atlanta, Chicago, Denver, Houston, Philadelphia, and San Francisco.

According to the commission, electronic media can reduce instructional costs in the long run, provide more flexibility of approach and a richer variety of content for the student.

"The new technology isn't going to replace the book and it isn't going to replace the teacher," Dr. Kerr, head of the Commission, said. "We're hoping that it can take care of more of other routine work and free the profession to spend more time with the students. Some aspects of it are more personal than the lecture method. It can have a humanizing effect rather than a dehumanizing one."

WHAT'S AN EDULP?

FOCUS ON HIGHER EDUCATION

This issue of Edu has its main focus on higher education products and applications. However, there's probably something of interest to everybody.

Got a contribution for a future issue? Send it to us!

HELP! DO YOU KNOW?

- Anyone using a MOOG or IONIC music synthesizer with a DIGITAL minicomputer?
- Anyone using a digitized audio system with a DIGITAL mini?
- Anyone using a DECISION, Inc. optical mark reader with a DIGITAL mini?
- Anyone using BASIC on a DIGITAL EduSystem for teaching high school geometry?

If you have information on any of the above, please let us know.

Education Products Group
Digital Equipment Corp.
Maynard, MA 01754

AMERICAN COUNCIL FOR THE TEACHING OF FOREIGN LANGUAGES

At the November 24-25 annual convention of ACTFL in Atlanta, Georgia, Dr. Ronald Turner, Chairman of the Department of Modern Languages of Whitworth College, demonstrated the use of an RSTS-11 computer system for teaching foreign languages. He used a CRT DECterminal (VT05) tied into a RSTS-11 running BASIC-PLUS. It was impressive!

NSF REVEALS SPECTACULAR GROWTH IN USE OF COMPUTERS IN HIGHER EDUCATION

Computers are invading the colleges! Or so one concludes after reading a comprehensive report sponsored by the National Science Foundation released recently.

The survey reveals that 1700 institutions of higher education are now spending $500 million annually for computer facilities and their operation.

Some 7.5 million students had access to a computer while only 845,000 students had none. 54% of 2 year schools had access to the computer. Over half of the schools with the highest offering at the bachelor's level also had computer access, compared to 69% for schools with the highest offering at the master's level and a startling 84% for schools offering doctorates.

See the PUBLICATIONS section for the specifics of the National Science Foundation Report.

An even more surprising fact is the number of students majoring in some computer-related discipline. In 1969-70, some 66,000 undergraduates concentrated in the field, as did 9,000 graduate students.

Degrees are awarded at all levels for computer-oriented disciplines, and in 1970-71, 13,309 students earned such honors:

LEVEL	1970-71 Degrees Awarded in Computer Disciplines
Associate	7523
Bachelor	3375
Masters	2069
Doctoral	342
TOTAL	13309

The growth of such programs has been nothing less than spectacular. In fact, the number of computer-oriented programs has more than quadrupled in the last six years!

# of Programs

Year	Assoc.	Bach.	Mast.	Doct.	Total
1964-65	83	44	61	38	226
1966-67	192	83	87	52	414
1971-72	464	239	159	94	956

An invasion is indeed taking place! The trend indicates it's gaining momentum!

WHAT'S AN EDULP?

ANATOMY OF A REVOLUTION

Revolution . . . Invasion . . . Call it what you will. But NSF findings and the Carnegie Commission report leave little doubt that computers already have had substantial impact on higher education, and their influence is just beginning!

How did all this happen? What else is in store for us? Many of the answers lie with DEC, the inventor of minicomputers, which has been committed to computers in higher education since the early sixties.

DEC designs computers for RESEARCH—and it provides the interfacing tools to make computers feasible for the university lab.

DEC designs computers for ADMINISTRATION—and it provides the tailored administrative packages schools can use without upsetting their present system.

DEC designs computers for INSTRUCTION—and it provides the curriculum materials and simulation programs to support it.

Read about how DEC did it in Management Today—see the PUBLICATION section of this issue of Edu.

What about the future? Read the article on the GT40, the self-contained programmable graphics system. Read the CLASSIFIEDS, and see the preparation tomorrow's graduates will need—from Vo/Tech schools to Doctorates. We're just beginning!

CALL FOR PAPERS - CCUC/4

Fourth Conference On Computers In The Undergraduate Curricula to be held June 18-20, 1973.
Papers due January 15, 1973

CCUC/4 is the fourth in a series of conferences designed to provide a forum for those interested in the applications of computers to undergraduate education. Started in 1970, the meetings have been a medium for reporting experience in using the computer to enrich, modify, or revamp undergraduate courses, and have provided an opportunity for faculty from all disciplines to learn from the efforts of colleagues throughout the country.

This year, the conference is being held at the Claremont Colleges under the auspices of the Institute of Educational Computing.

For details . . . write:

Bill Koteff
Conference Co-ordinator
Institute For Educational Computing
McConnell Center
Pitzer College
Claremont, California 91711

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AAAARRRGH!!!
HARRY, WILL YOU SHUT OFF THAT TELETYPE!!!

Rattled by the clatter of your standard teletype? Tired of waiting for it to cough up that last PRINT statement?

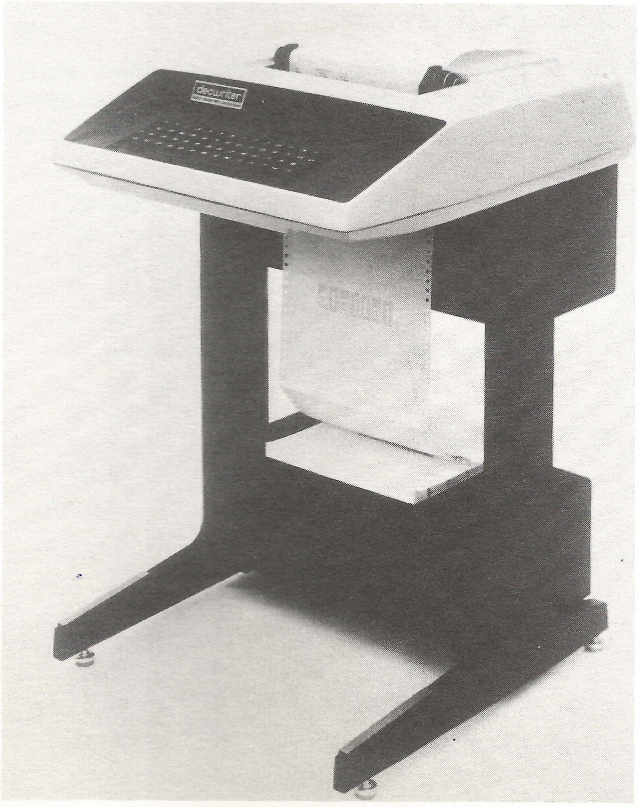
Ponder for a moment the miracles of a DECwriter. Three times as fast as the teletype! Quieter than an electric typewriter! Able to leap service calls with a simple mechanism! 64 characters of classy dot matrix impact printing:

DECwriter type sample

```
HERE IS A SAMPLE  OF  DECWRITER  COPY
REPRODUCED FULL SIZE.  EACH CHARACTER
HAS  BEEN  DERIVED  FROM  A 5 X 7 DOT
MATRIX.  NOTE THE CLARITY.


THE LA 30 PRINTS FROM  THIS SET OF 64
CHARACTERS  AT  SPEEDS  OF UP  TO  30
CHARACTERS PER SECOND:


ABCDEFGHIJKLMNOPQRSTUVWXYZ
1234567890
!"#$%&'()*+,-./:;<=>?@ [\]^_
```



This showpiece of a terminal looks like it acts—the LA30 DECwriter terminal.

All for $2795. Is it worth it, Harry?

P.S. Here's the specs:

Printer Printing Speed:	30 characters per second, asynchronous; 300 ms carriage return
Line Length:	80 character positions
Character Spacing:	10 characters per inch
Line Spacing:	6 lines per inch
Paper:	9-7/8 inch wide tractor-driven continuous form original plus one copy
Typeface:	5 x 7 dot matrix
Interface:	Available for all Digital Equipment Corporation computers
Ribbon:	1/2-inch x 120 feet, nylon
Data Entry Code:	USASCII—1968 96 characters (128 optional)
Interface:	Available for all Digital Equipment Corporation computers
Environmental/ Physical Temperature:	50 F—100 F
Humidity:	5-90% (noncondensing)
Power:	Type LA30-A: 115VAC, 50-60 Hz Type LA30-B: 230VAC, 50-60 Hz
Dimensions:	20-1/2 inches wide x 31 inches high x 24 inches deep

DID YOU KNOW?

- Proficiency in two foreign languages has long been a part of the Ph.D. degree requirements. Four hundred seventy schools now permit a proficiency in a computer language to meet one of the language or research tool requirements for the Ph.D.!
- 84% of U.S. Schools offering doctorates had access to the computer.
- Colleges and Universities spend $500 million per year on computers and their operation. Here's how the expenses are distributed:

Administration	34%
Research	32%
Instruction	30%
Services to Other Schools	3%
Services to Industry	1%

- 13,309 degrees were awarded in computer related programs in the 1970-71 academic year.

PROGRAM OF THE MONTH - "FORCES"

Program FORCES was submitted by Bro. Paul Scheiter of De La Salle College, Manila, Philippines. The program adds any number of two-dimensional forces by rectangular resolution. It is based on "University Physics" by Richards, Sears, Wehr, and Zemansky, Chapter 1, Section 9.

```
 10 REM "FØRCES" BY BRØ. PAUL SCHEITER 5 ØCTØBER 1972
 20 REM ADDS N TWØ-DIMENSIØNAL FØRCES BY RECTANGULAR RESØLUTIØN
 30 REM BASED ØN RICHARDS, SEARS, WEHR, & ZEMANSKY'S "UNIVERSITY PHYSICS"
 40 REM CHAPTER 1, SECTIØN 9
100 PRINT "NUMBER ØF FØRCES";
110 INPUT N
160 PRINT "GIVE FØRCE MAGNITUDE, STD. ANGLE DEGREES AFTER EACH QUESTIØN."
170 PRINT "FØRCE  ANGLE  X-CØMPØNENT   Y-CØMPØNENT"
180 FØR I=1 TØ N
190 INPUT F, A                              'FØRCE, ANGLE
200 LET B=A*3.14159265/180              'CHANGES ANGLE DEGREES TØ RADIANS
210 LET X=F*CØS(B)                      'X-CØMPØNENT
220 LET Y=F*SIN(B)                        'Y-CØMPØNENT
230 PRINT "          ",X,Y
240 LET S1=S1+X                       'RUNNING SUM ØF X-CØMPØNENTS
250 LET S2=S2+Y                       'RUNNING SUM ØF Y-CØMPØNENTS
260 NEXT I
310 PRINT "CØMPØNENT SUMS",S1,S2
320 LET R=SQR((S1↑2)+(S2↑2))            'CØMPUTES RESULTANT MAGNITUDE
330 LET T=(180/3.14159265)*ATN(S2/S1)   'CØMPUTES ANGLE ØF RESULTANT
340 PRINT "RESULTANT MAGNITUDE =";R;", ANGLE =";T;"DEGREES"
360 END

READY

RUN

NUMBER ØF FØRCES? 3
GIVE FØRCE MAGNITUDE, STD. ANGLE DEGREES AFTER EACH QUESTIØN.
FØRCE  ANGLE  X-CØMPØNENT   Y-CØMPØNENT
? 120,    0
               120            0
? 200,   60
               100            173.2051
? 150,  225
              -106.066       -106.066
CØMPØNENT SUMS 113.934        67.13907
RESULTANT MAGNITUDE = 132.2445 , ANGLE = 30.51001 DEGREES


READY

RUN

NUMBER ØF FØRCES? 1
GIVE FØRCE MAGNITUDE, STD. ANGLE DEGREES AFTER EACH QUESTIØN.
FØRCE  ANGLE    X-CØMPØNENT   Y-CØMPØNENT
? 40,   50
               25.7115        30.64178
CØMPØNENT SUMS 25.7115        30.64178
RESULTANT MAGNITUDE = 40 , ANGLE = 50 DEGREES


READY

RUN

NUMBER ØF FØRCES? 1
GIVE FØRCE MAGNITUDE, STD. ANGLE DEGREES AFTER EACH QUESTIØN.
FØRCE  ANGLE  X-CØMPØNENT   Y-CØMPØNENT
? 40,   30
               34.64102       20
CØMPØNENT SUMS 34.64102       20
RESULTANT MAGNITUDE = 40 , ANGLE = 30 DEGREES
```

GAMES COMPUTER BUMS PLAY

Ever heard of a computer language? That's the alphabet soup that computer bums talk, right? To make it a real bummer, most of 'em add numbers to the letters and call it clarity when they say a 0 is a 0!

Well now we've got a stopper for them. Only the best of bums will get this one . . .

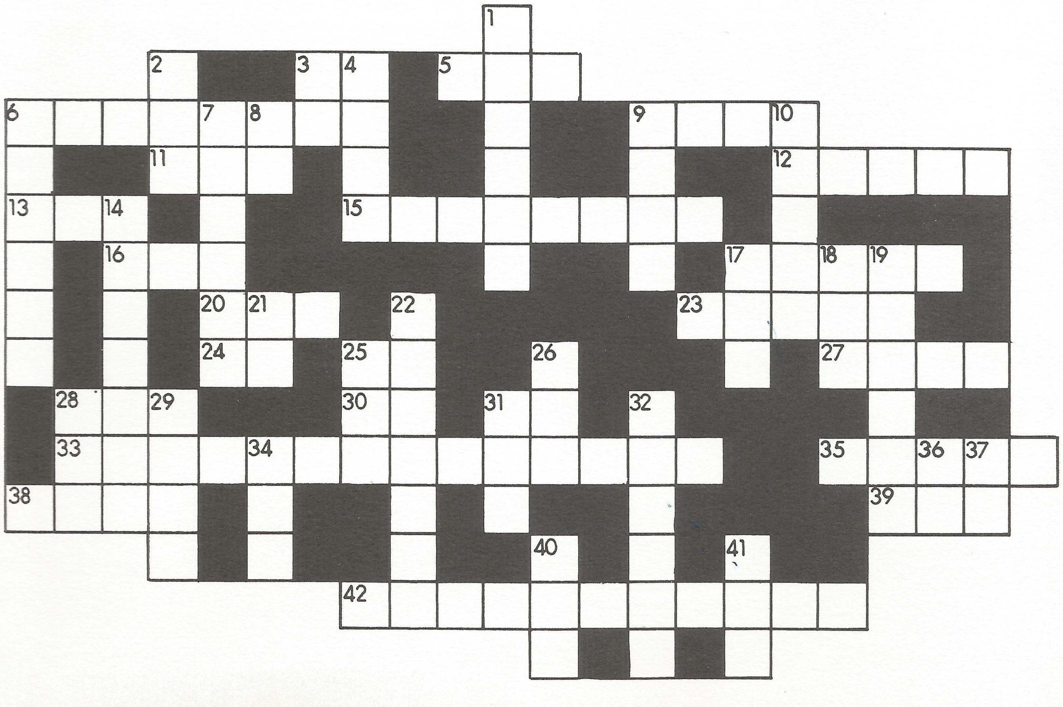
Answer in next issue of EDU.

ACROSS

3 Abbreviation for a basic component of Digital computer
5 A powerful, comprehensive and low cost library of system programs operating under the supervision of an integrated executive for the PDP-8
6 One of three major tasks with which the computer can help colleges and universities
9 An adjective for EDU products
11 Explosive
12 What's an ______________?
13 Command to return to BASIC monitor
15 A powerful medium-scale computer in the PDP-11 family
16 Abbreviation for BASIC command to eliminate a line of code
17 A computer simulation of a moon landing
20 Debugging method on PDP-8
23 A high-level computer language popular in education
24 FOCAL branch command
25 A FORTRAN command
27 DEC order number for the ASR33 teletype
28 Inventor of minicomputers and leader of the industry
30 The study of operations using computers
31 Type of Engineering
33 An education task simplified by computers
35 A fundamental computer principle to be taught in technical schools
38 The workhorse of the mini-computer industry
39 A phenomenon used for organic chemical analysis in conjunction with DEC computers
42 The major higher education task simplified by computers

DOWN

1 A powerful resource time-sharing system which runs on the PDP-11
2 File read in BASIC
3 See #3 across!
4 FLIP---- (You can have your own, see Edu #5!)
6 Teletype mistakes can be corrected with this key
7 A type of signal
8 Real time
9 A programmable graphic display unit
10 An organization dedicated to interchange of computer ideas and information
14 The technique by which DEC can simplify school administrative tasks
17 A place for research with the computer
18 0
19 The computer industry is full of it!
21 Enter subroutine command in FOCAL
22 A high-level computer language
25 An operating system requiring a disk as the systems device
26 A BASIC command
28 Father
29 Order number for DEC's newest optical mark sense card reader
31 Hardware to speed up calculations
32 The area of education which will produce future technicians and programmers
34 Assembly language code for doing nothing and taking 1.2 microseconds to do it! (PDP-8)
36 A great automobile manufacturer which uses DEC equipment on its production lines
37 Electromagnetic radiation used in organic chemical analysis in conjunction with DEC computers.
40 Used in the VT05
41 A program which simplifies use of peripherals



GOOD BUSINESS MEANS BAD ETHICS!

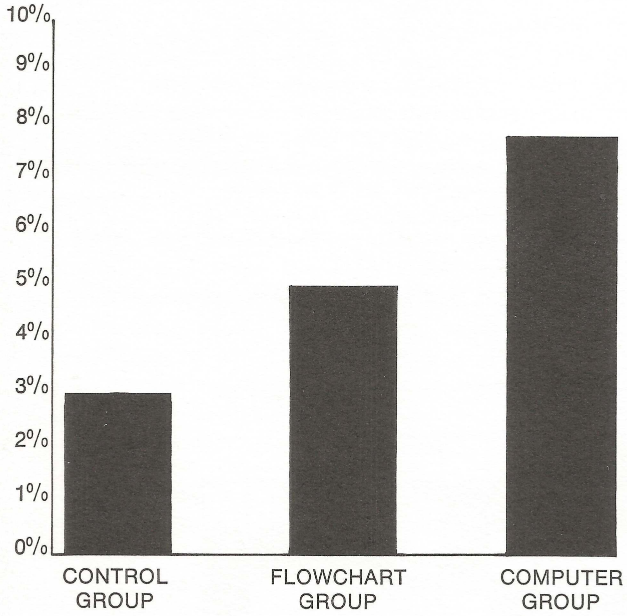
PROFITS AND THE SOCIAL GOOD DON'T MIX!!!

Here is a case where the familiar cry doesn't ring true. In fact, one might argue that the company has a moral responsibility to remain profitable so it can *continue* to serve society.

DEC employees recently called for the company to apply its technological know-how to training vocational and technical school students in the fundamentals of digital logic and computer design. Our personnel, manufacturing and service groups joined the chorus—their need for trained people is desperate. The marketing and sales people added their vote—they know what DEC equipment can do for education, and they support their claims with data like the following:

PROJECT LOCAL GRAPH

PERCENTAGE CHANGE IN GROUP MEAN FROM PRE TO POST GENERAL SCHOLASTIC APTITUDE TEST



SOURCE: Project LOCAL, Inc. Westwood, Massachusetts 1968

Community activists, manufacturing, personnel, service, marketing, sales—can the financial analysts be far behind?

> "What is good teaching? Giving opportunity to the student to discover things by himself."
> Herbert Spencer

PUBLICATIONS

- Inventory of computers in U.S. Higher Education, Library of Congress Catalog No. 74-609402, U.S. Government Printing Office, Washington, D.C. 20402, $3.

  NSF survey.
- Computer Newsletter, 2611 Northridge Drive, Box 9630, Colorado Springs, Colorado, 80909, $11 per year.

  A newsletter published for instructors of data processing packed with interesting tidbits.
- "Digital Equipment's Puritan Profit," Management Today, June 1972.

  The fascinating story of a puritan corporate giant, whose thrifty president leads his organization into the forefront of technology.
- Computer Models In Operations Management, Harris and Maggard, Harper and Row Publishers, Inc., 1972.

  Ten computer cases to teach management analysis. An instructor's manual is also available.
- Computer Lab Workbook, DEC, 1969.

  A complete course in digital logic. Intended to accompany courses in binary arithmetic, Boolean algebra, digital logic or computer technology.
- *2 BOOKS!* PDP8 Programming Fundamentals ($2.75); PDP11 Programming Fundamentals ($3.50), R. W. Southern, Algonquin College Bookstore, Ottawa, Ontario, Canada, 1972.

  Self-instructional workbooks for assembly language programming on the PDP8 and PDP11 families of computers.
- Digital Control Handbook, DEC, 1970.

  A practical guide to solid state control logic.
- Proceedings of the 1972 conference on computers in the Undergraduate Curricula. Library of Congress No. 72-83189. Distributed by the Southern Regional Education Board, Atlanta, Georgia 30313.

  Papers on the use of computers in all curricula: sciences and engineering, business, education, geography, social sciences, languages and art.
- DECUS proceedings, Spring 1972. Available from DECUS, 146 Main Street, Maynard, Massachusetts 01754. (Sound Familiar?)

  Chock full of interesting ways to use our products. Also . . . find out what our users really think of us!!

NEW RSTS-11 MANUALS

RSTS Documentation now comes in three shiny manuals:

BASIC-PLUS Language Manual.
RSTS System User's Guide.
RSTS System Manager's Guide (restricted to Genuine System Managers).

See the order form in the back to get yours.

A FEW CHOICE WORDS ABOUT RJE

RJE (Remote Job Entry) used to be dull. You punched up your deck, worried about control cards, shuffled over to the 2780, stuck your deck in the card reader, and waited nervously for the remote, aloof IBM 360 or 370 to either smile or frown on your printout.

Well, nothing's really changed. The RJE part is still pretty dull; you still have to do basically the same stuff. Except now, instead of shuffling up to a 2780, which probably never even blinked at you, you can shuffle up to a warm, wonderful PDP-11! It'll do exactly the same thing: read your cards, transmit and receive your job, print the results—for just about the same money, or maybe slightly less. But that's where the similarity ends, and where things start to get exciting.

You see, the problem is that your 2780 couldn't do anything else. Reading cards, printing paper, and talking on the telephone was really the extent of its repertoire. Our RJE terminal only starts there. By adding a few more selected pieces to it (with a few more dollars), you can build yourself an EduSystem 70, a neat interactive BASIC-speaking system for simultaneous use by up to 8 users. By adding still more pieces (with still more dollars), you can ultimately end up with a full-blown RSTS-11 system. Since it speaks the powerful BASIC-PLUS language, you might find you no longer need FORTRAN or ALGOL. Since it can accommodate a large amount of disk storage and handle magnetic tapes, you might find that you don't need the bigger system for file space, either.

In fact, you might find eventually that you don't really need the bigger system at all. But even if you still do, that's O.K. We won't mind if you still use it as an RJE terminal for a few hours a day. After all, that's what you bought to begin with!

PDP-11 based Remote Batch Terminal
System Description

System Building Block (8K, TTY)	
Line frequency clock	
Synchronous Communications Adapter	
Communications Arithmetic Element	
Punched card reader, 200 cpm	
Prewired System Unit	
COMTEX 2780 software	
TOTAL SYSTEM PRICE (ADD LINE PRINTER BELOW)	$21,570

Line Printers (select one):

LP11-FA	80 column, 300 lpm	$12,000
LP11-JA	132 column, 300 lpm	$17,500

CARSON-NEWMAN BUYS COMPUTER FOR EDUCATIONAL USE

JEFFERSON CITY—The Business Department of Carson-Newman College has purchased an EduSystem 20 computer developed by the *Digital Equipment Corporation.*

The EduSystem 20 is a complete self-contained, time-sharing system which will allow three students and teachers to work simultaneously, but independently. Each will work at his own terminal, without interference from others. The PDP-8/E tabletop computer, one of the component parts of the EduSystem 20, has a 12,000 word core memory, power failure protection, automatic loader, and computer terminals and other associated divisions. Another component part is the BASIC Language Processor which will allow students without any previous computer experience to run programs.

EduSystem 20 not only handles more users, it handles more sophisticated problems as well. However, the computer will be used only for instructional purposes. Installation is slated this September in the new Dougherty Science Center. James A. Coppock, chairman of the Carson-Newman Business Department, will be supervisor of computer activities.

(Reprinted from the Greenville Sun, Greenville, Tenn. 8/10/72.)

> "Mathematics is the science that yields the best opportunity to observe the working of the mind . . . and has the advantage that by cultivating it we may acquire the habit of a method of reasoning which can be applied afterwards to the study of any subject and can guide us in the pursuit of life's object."
>
> Condorcet

CLEARLY A WINNER EDUSYSTEM 25

Only two months after its introduction, EduSystem 25 is already proving to be a winner.

The newest of the Intermediate Systems is based on the proven, reliable PDP8/E processor, with 12K (24,000 bytes) of core memory and DECtape, too. EduSystem 25 is a core resident timesharing system that supports up to 8 student users simultaneously!

Sounds like EduSystem 20?

The superiority of EduSystem 25 unfolds with the extended features of EduSystem 25's BASIC language. It contains all the same goodies that EduSystem 20 has, and more:

EduSystem 25 has PROGRAM STORAGE!

The addition of DECtape provides temporary or permanent program storage capabilities to all 8 users.

EduSystem 25 has DATA FILE STORAGE!

Students can build their own data files on DECtape and retrieve that data at a future time. And teachers can create common data files that can be used to test student programs!

EduSystem 25 has STRINGS!

Six character EduSystem 50—like Strings! Students can input, manipulate and output alphanumeric strings, six characters at a time.

EduSystem 25 has CHAINING!

Students can write longer programs (up to 10,000 lines!) using the BASIC "CHAIN" command. Without it, maximum program length is 250 lines.

EduSystem 25 has MULTIPLE STATEMENTS PER LINE!

Bigger programs can be written without chaining, using the multiple statements per line capability. More than one BASIC statement can be written in one line which means *more* program without more memory!

EduSystem 25 BASIC is EduSystem 20 BASIC with the following additions: OLD, NEW, CATALOG, UNSAVE, SAVE, INPUT A$, PRINT A$, IF A$='String' THEN——, LET A$='String' CHAIN, FILE name, GET list, PUT list, and CLOSE.

But EduSystem 25 offers more than this powerful multiuser BASIC! Your students can use FOCAL, FORTRAN, and Assembly Language, too! Imagine!

If you have an EduSystem 20 today and you'd love to grow to an EduSystem 25 . . . *all* you need is an additional 4K of memory and DECtape. And EduSystem 25 software, of course.

To expand from EduSystem 25 to EduSystem 40 requires only an optical mark card reader. And then EduSystem 50 is only an RF/RS08 disk away!

WHAT MAKES DIGITAL RUN?

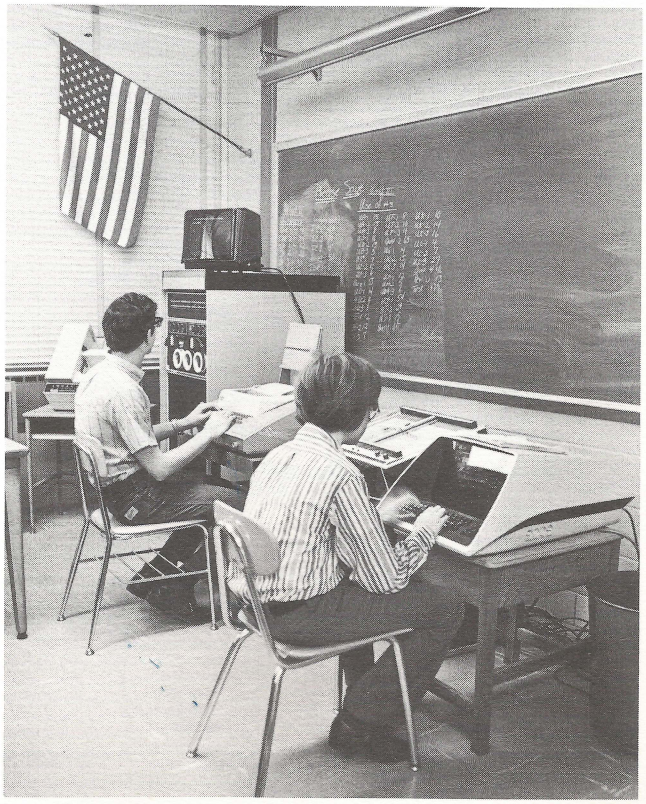
"Dear Digital, Why don't you add Print Formatting to EduSystem 25 BASIC?" or "What kind of a power recepticle is needed for a RK8-E disk?" or, "You promised my system to me on September 1st; where is it?" or, "I'm editor of *Physics History*; will you advertise in our magazine?" or, "Has anyone used a PDP8 for school menu planning?" Etc.

As the major manufacturer of minicomputers, Digital receives literally *tens of thousands* of specific requests for information or solutions to problems *every week*. This is *in addition* to "routine" requests for sales literature or for "standard" published information.

We'd like to tell you how such inquiries are handled and hopefully, give you a little insight into the management of our business. Digital is organized around the Product Line or Product Group concept. The Education Products Group, for example, is responsible for managing the products sold into educational institutions for instructional or administrative purposes. Seventeen other product groups manage Digital's products in industrial, lab research, computational, typesetting and a host of other market areas.

The Product Group itself consists of a relatively small number of managers and specialists. You might think of the Group as having four broad functions:

1. *Planning*. New software system configurations, pricing, direct mailings, advertising, literature, conference participation, demonstrations, curriculum material—all and many more are planned by the Product Group.



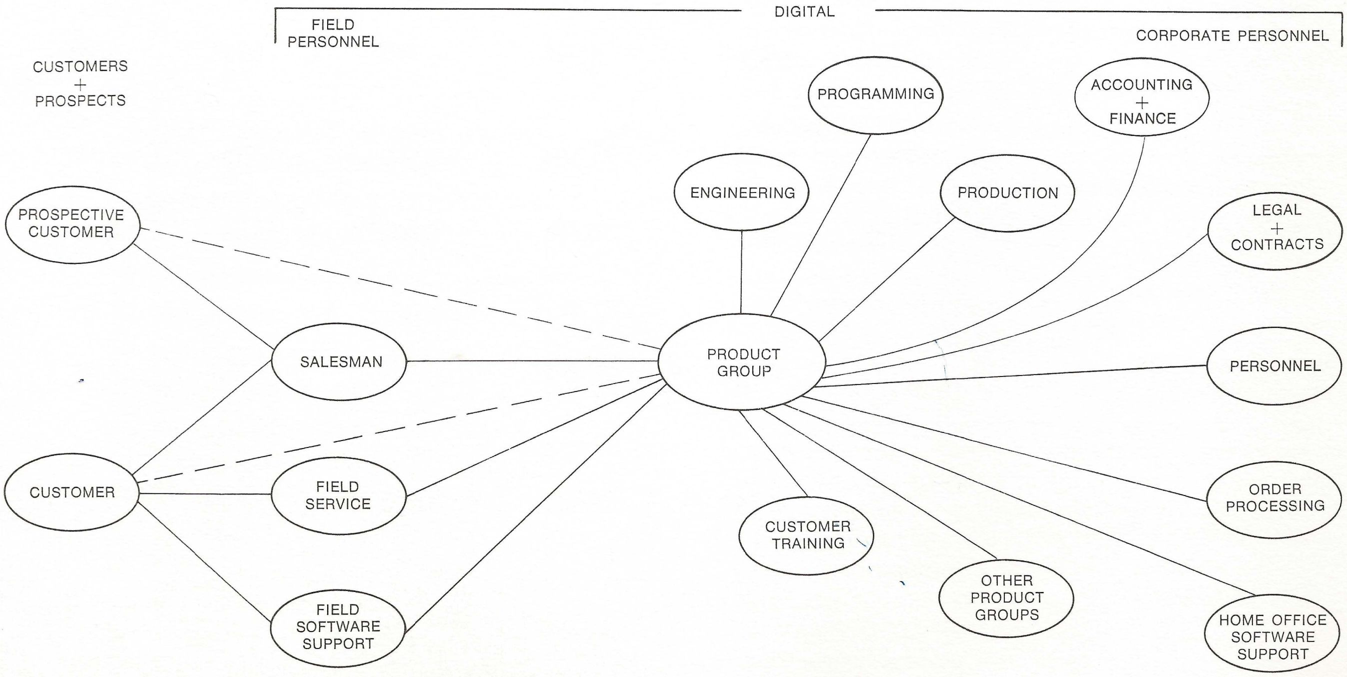
2. *Execution*. For the most part, the Product Group executes the marketing functions directly (literature, mailings, conferences, etc.) and oversees the execution of non-marketing tasks by other appropriate departments or groups. For example, software is written by the Programming Department, hardware designed by Engineering, computers sold by Sales, serviced by Field Service, etc.
3. *Communication*. The Product Group is the communication link between customers, salesmen, production, programmers, and all the internal groups in Digital.
4. *Evaluation*. The Product Group principally measures its progress against its own budgetary forecasts. However, the Group also considers: How does Digital stack up against its own past performance? Against non-financial objectives? Against its competitors?

With the Product Group acting as a two-directional communications funnel, you might expect things to get bogged down—and occasionally they do! However, in the Education Products Group, as with most others at Digital, various people are totally responsible for a defined area.

Occasionally customers try to "cut some red tape" by going to the Product Group Manager or even a Vice President with a question or problem. What they probably don't realize is that 99 percent of the time their request winds up being handled by the Product Group specialist to whom they could have gone directly in the first place! Much of Digital's outstanding performance is a result of the personal satisfaction and motivation that comes from disseminating decision-making responsibility to these young men and women in the Product Groups.

In the Education Products Group, eight managers and specialists serve as the backbone of this dynamic group.

- Product Group Manager (David Ahl)
- Marketing Manager—Higher Education (Bob Meese). Primary responsibility is in the area of college computer centers and, as such, Bob handles RSTS-11 and Remote Job Entry Terminals.
- Marketing Manager—Higher Education (Charlie Mead). Handles "dedicated" applications in college and university departments including psychology, computer science, EE, etc.
- Marketing Manager—Secondary Education (Alice Peters). Handles administrative applications such as student and school records, scheduling, attendance, grades, and the like.
- Marketing Manager—Secondary Education (Sally Richards). Instructional applications in the area of math, science, business, social studies, and computer science are the responsibility of this position.
- Marketing Manager—Vocational/Technical Education (Alan Mowbray). Instructional applications in vocational and technical schools such as logic design, computer maintenance, electronics, and EDP fall under this position.
- Technical Support Specialist (Mary Cole). Responsible for software support for all educational products as well as overseeing our new software development effort.
- Administrative Specialist (Betsy Pyne). Responsible for order processing, scheduling, trade shows and conferences, and direct mailings.



NEW LOWER PRICES FOR EDUSYSTEMS!!

Prices below include one terminal. All you need to add is the number of extra terminals you want!

PDP-8 BASED SYSTEMS

EduSystem 5 Supercalculator	$ 5,790
EduSystem 10: Single-user BASIC	6,960
EduSystem 15: Single-user BASIC	9,850
EduSystem 15: Batch BASIC	14,790
EduSystem 20: Up to 4 users	8,370
EduSystem 20: Up to 8 users	11,370
EduSystem 21: Up to 4 users	11,370
EduSystem 21: Up to 8 users	12,770
EduSystem 25: Up to 4 users	21,790
EduSystem 25: Up to 8 users	23,190
EduSystem 30: Fast Batch BASIC	19,260
EduSystem 30: Interactive only	14,360
EduSystem 30: Based on DECtape	22,030
EduSystem 40: 4 users and batch	20,820
EduSystem 40: 8 users and batch	23,820
EduSystem 40: (DECtape): 4 users	23,590
EduSystem 40: (DECtape): 8 users	26,590
EduSystem 45: Up to 4 users	26,890
EduSystem 45: Up to 8 users	28,290
EduSystem 50: Up to 4 users	36,850
EduSystem 50: Up to 8 users	38,250
EduSystem 50: Up to 12 users	51,950
EduSystem 50: Up to 16 users	53,350
EduSystem 50: Super	72,050
DECtape-based administrative EduSystem	50,820
EDU40/EDP based on cartridge disk	49,570
EDU40/EDP with RF08 and TS/8 Software	68,950

PDP-11 BASED SYSTEMS

Single-user interactive BASIC system	$17,720
EduSystem 70 for up to 8 users	22,470
RSTS, 8 users, 11/40-RE based	46,645
RSTS, 16 users, 11/40-RE based	53,195
RSTS, 8 users, 11/40-RC based	50,945
RSTS, 8 users, 11/40-RA based	42,095
RSTS, 32 users, 11/45-RA based	117,425
11/40 based remote batch terminal	21,570

SUMMARY OF COSTS FOR SMALL AND MEDIUM TIMESHARING SYSTEM

SYSTEM DESCRIPTION	TERMINALS* NO.	TERMINALS* TYPE	PURCHASE PRICE	ANNUAL LEASE & MAINTENANCE	SUPPLIES, PAPER	TOTAL PER YEAR	TOTAL PER TERMINAL
EduSystem 5 Supercalculator	1	TTY	$ 5,790	$ 2,496	$ 500	$ 2,996	$2,996
Edu System 15 Program storage on DECtape	1	TTY	9,850	4,004	550	4,554	4,554
EduSystem 20 Core based multi-user	8	TTY	24,810	11,134	3,000	14,134	1,767
EduSystem 25 Multi-user with program and data storage on DECtape	8	TTY	36,630	15,166	3,300	18,466	2,308
EduSystem 50 Timesharing, multi-language, swapping disk, DECtape	16	TTY	82,150	32,404	4,800	37,204	2,325
RSTS-11 Timesharing BASIC-PLUS, swapping disk, DECtape	16	TTY	81,995	32,183	4,800	36,983	2,311

* In schools with limited access hours, one terminal typically serves from 60 to 90 students; with extended hours, a terminal can serve 90 to 140 students. This assumes median student usage of 20 minutes per student per week. After the program has been established 4 to 5 years, student usage increases to 50-60 minutes per week.

TIMESHARED-8: THE BIG LITTLE SYSTEM

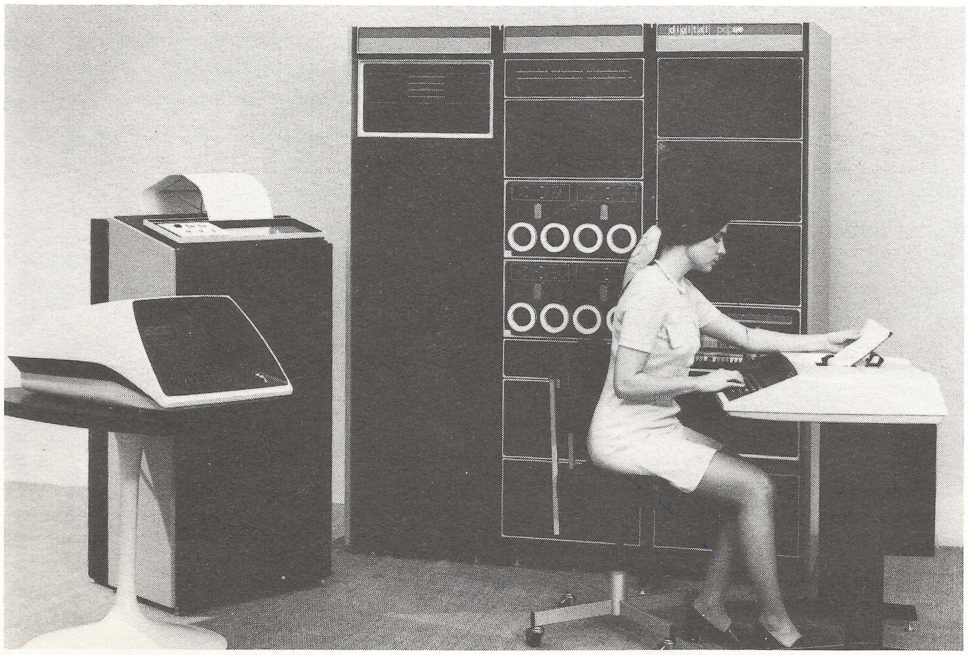
Q. What do the following colleges and universities have in common?

Associated Colleges of Central Kansas	McPherson, Kan.
Bemidji State College	Bemidji, Minn.
Benedict College	Columbia, S. C.
Berkshire Community College	Pittsfield, Mass.
Brigham Young Univ.	Provo, Utah
Brooklyn College	Brooklyn, N.Y.
Cambridge Univ.	Cambridge, England
Carleton College	Northfield, Minn.
Carnegie-Mellon Univ.	Pittsburgh, Pa.
Catholic Univ. of Leuven	Leuven, Belgium
City Univ. of New York	New York, N. Y.
Clarkson College	Pottsdam, N. Y.
Clemson Univ.	Clemson, S. C.
Emory and Henry College	Emory, Va.
Florida State Univ.	Tallahassee, Fla.
Hollins College	Hollins College, Va.
Indiana Univ.	Bloomington, Ind.
Northern Arizona Univ.	Flagstaff, Ariz.
Oak Ridge Associated Universities	Oak Ridge, Tenn.
Ontario Institute for Study in Education	Toronto, Ontario
Polytechnic Institute of Brooklyn	Brooklyn, N. Y.
Red River Community College	Winnepeg, Manitoba
Ripon College	Ripon, Wis.
St. Lawrence College	Cornwall, Ontario
Trinity College	Hartford, Conn.
University of Calgary (2)	Calgary, Alberta
University of Minnesota (2)	Minneapolis, Minn.
University of Wisconsin	Milwaukee, Wis.

A. Right . . . they all have at least one Timeshared-8 on campus. (Calgary and Minnesota have two!) Timeshared-8, alias TSS/8 and EduSystem 50, has grown up to be one of Digital's most successful products ever. The above list is only representative of the higher-education users of TSS/8; when secondary education, business and government users are added in, the list grows to over one hundred.

Why such popularity? Because Timeshared-8 has big-league features at a very small price. Features like multiple languages (BASIC, ALGOL, FORTRAN, FOCAL, and Assembly PAL Language), available simultaneously to all users. Resource-sharing, meaning that each terminal user has access to all of the system's peripherals and devices. TSS/8 makes all this power available to up to 17 simultaneous users at a cost of *under $1.00* per terminal-hour.

This happy event came to pass because DEC was able to combine its leadership in the minicomputer field with the knowledge and experience gained from developing the powerful timesharing software used on the DECsystem-10. We haven't finished yet with Timeshared-8. In fact, very soon we're going to announce a new enhancement to the system that will put it in a class by itself. It will be presently a minicomputer system with large system capabilities—and even among large systems, only two will be able to match it! Keep your eye on subsequent issues of Edu for details! If you'd like to guess what it is, send your guesses to EduMan. We'll print the 10 most interesting responses, and the first correct response to reach our desk will win its sender a free bar of Edu Crunch. (In case of tie, duplicate prizes awarded for all winning entries received on the same business day.)



GT40 GRAPHICS SYSTEM

The GT40 is a high performance, computer level graphics system. It is an intelligent terminal consisting of a graphical display system and a powerful general purpose minicomputer. The GT40 can operate as a stand alone system or it can initiate dialogue with a host computer.

Features

Powerful Display Processor
PDP-11 Central Processor
Visual Display Monitor
Light Pen
Full ASCII Keyboard
Serial Communication Interface
ROM Bootstrap Loader
Real Time Clock

Display Processor (DPU)

The DPU is the "heart" of the GT40's graphics capability. The DPU fetches and executes its own instructions and data from memory, thereby minimizing CPU overhead. The use of digital techniques provides a stable system with a minimum number of adjustments. For example, ten bit resolution (1024 x 1024 addressing) in X and Y is precise enough to allow overprinting. Hardware drawn characters use a visually pleasing 6 x 8 dot matrix (font). The available character set includes: 96 ASCII character (upper and lower case), 31 special characters, including some Greek letters, APL symbols and math symbols, control characters and italics for all of the above mentioned characters. The screen can accommodate 31 lines of 80 characters.

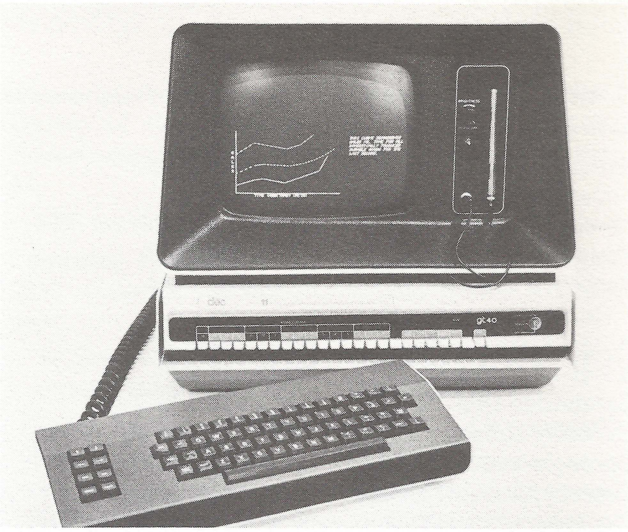
Hardware drawn vectors employ a constant velocity technique and have four line types available to the user. Seven programming modes are available including character mode, long vector, short vector, point mode, Relative Point mode and X and Y Graph-plot modes. Eight intensity levels are standard as is hardware blink.

PDP-11 CPU

The GT40 makes efficient use of an "11 family" type computer with features such as a 16 bit general purpose, multi-register microprogrammed CPU; and extensive, powerful instruction repertoire having stack capabilities and having bit/byte/word handling capability; reliable, high speed MSI construction; UNIBUS—the versatile, bidirectional, large bandwidth bus architecture which is central to the PDP-11 type computer; compatibility with and capacity to expand to more sophisticated PDP-11 systems with a comprehensive set of both peripherals and software systems.

Visual Display Monitor

The GT40 uses the RV14—a 12-inch diagonal, high performance display tube with excellent brightness and contrast ratios.



Light Pen

The GT40 is equipped with a solid-state light pen for user interaction with the system. The light pen can perform such functions as "Menu" selection, subpicture action and drawing.

Full ASCII Keyboard

A full 128 character keyboard is available having upper and lower case characters as well as a 7 key function panel to facilitate signal button commands to the GT40.

Serial Communication Interface

The GT40 system contains a versatile communications controller—a DL11 with the following features: asynchronous communication, separate switch selectable speeds for transmit and receive up to 9600 baud and selectable electrical characteristics from current loop (TTY), EIA or DATASET.

TUFTS BUYS DIGITAL DECSYSTEM-10 FOR $437,000

MEDFORD—Tufts University has purchased a large-scale DECsystem-1040 computer system from *Digital Equipment Corporation,* Maynard. Valued at $437,000 the new computer is slated to be used by students and faculty for general academic work, especially in the area of liberal arts.

Dr. Bernard W. Harleston, Dean of the Faculty of Arts and Sciences at Tufts, said, "This computer is going to enable us to do an urgent job far better than we have done in the past—to bring to the students the importance of the computer as a research tool and as a teaching instrument. It will facilitate independent study and influence the development of curriculum."

The present system is a small limited language computer and is used primarily in the College of Engineering.

(Reprinted from the Lowell Sun,
Lowell, Mass. 7/31/72.)

PROCEDURE FOR RIGHT-JUSTIFYING NUMBERS

The following line may be inserted in a BASIC program to right justify a given number:

```
PRINT TAB (T—INT(LOG(ABS(N))/LOG(10))); N
```

where:

T = tab point for the decimal point of the number
N = number to be right justified

The formula INT(LOG(ABS(N))/LOG(10)) yields the number of significant digits left of the decimal point for the number N. Then (T—INT(LOG(ABS(N))/LOG(10))) is the position for the left-most digit of a given number N.

Example:

```
LIST
   10 READ N
   20 T = 10
   30 PRINT TAB (T—INT(LOG(ABS(N))/LOG(10))); N
   40 GO TO 10
   50 DATA 1.4999, 34.2, 666.5, .7, 9999
   60 END
READY
RUN
            1.4999
           34.2
          666.5
             .7
         9999
```

Programming adjustments must be made to insure that N = 0.

In the following programming sample, lines 25 and 46 have been added to insure numbers less than .1 will be right justified properly.

```
LIST
   10 READ N
   20 T = 10
   25 IF ABS(N) < .1 THEN 46
   30 PRINT TAB (T—INT (LOG(ABS(N))/LOG(10)));N
   40 GO TO 10
   46 PRINT TAB (T—INT(LOG(.1+ABS(N))/
      LOG(10)));N
   48 GO TO 10
   50 DATA 3.98, 55.66, 333.65, .04, .55, 2.33
   60 END
READY
RUN
            3.98
           55.66
          333.65
             .04
             .55
            2.33
```

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Eliminate Those Crowds Around Your Teletype!

Let Everyone See What's Going on—hook your VT05 terminal up to a TV Monitor. All you need is a cable, and here's how you get it:

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A cable RG58 c/u
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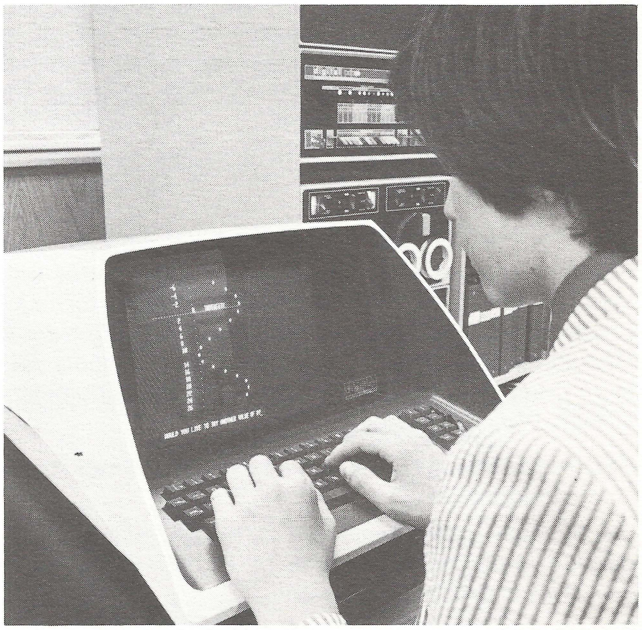
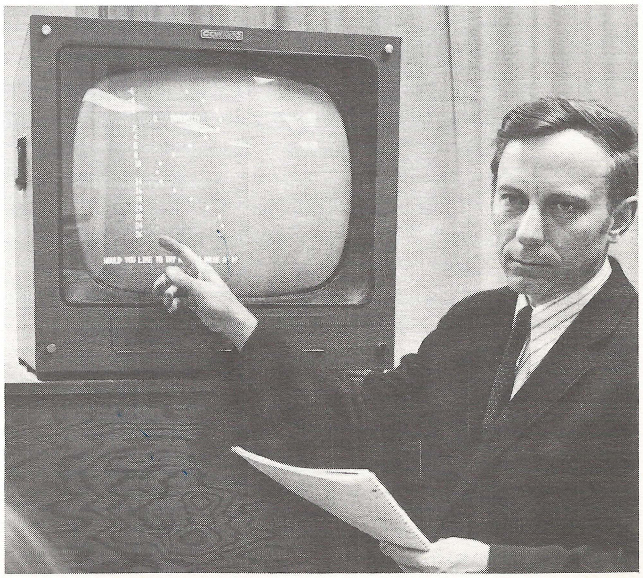
CITE: 1972 36th Edition
The Radio Electronic Master
Page 369

INCLUDE: $6.90 for every cable you order.

NEAT!





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If schools offer the right subjects, graduates get jobs! In these times of unemployment, wage/price freezes, profit controls, and general economic crunch, there is no lack of jobs in the computer industry.

DIGITAL is growing at a tremendous rate. FORTUNE magazine, in a recent survey, described DIGITAL as "the tenth greatest growth company in the United States during the past decade." DIGITAL presently employs over 8,000 people worldwide, an increase of 30% over last year. In the current year, we anticipate 700 professional openings in our sales and customer service organizations alone. Many more openings for "in-house" personnel exist too.

The following is a sample of the jobs available at DIGITAL *right now!*

ELECTRICAL ENGINEERS—(B.S.E.E., M.S.E.E.)

Positions require electrical engineering graduates with experience in logic or circuit design related to memories, peripherals and control processors. Computer Circuit Design, Computer Logic Design, Memory Design, Computer Systems Design, Peripheral Equipment Design, Project Engineers.

TECHNICIANS—(A.S.E.E. or equivalent 2 years training/experience)

Technicians assist engineers in design, support production department in areas of expertise and solve problems in existing equipment.

SALES ENGINEERS—(B.S.E.E./M.B.A., B.S.E.E., M.S.E.E./M.B.A., M.S.E.E., B.S.—Physics/Math, B.S.—Computer Science)

These positions involve matching our many products to a wide range of needs, analyzing systems requirements, configuring and pricing, and full responsibility for servicing accounts. Openings exist nationwide in the following types of markets: Communications, Industrial, Computation, Hospital, Commercial, Graphic Arts, Typesetting, OEM, Education, Logic Products, and Scientific. Depending on market of concentration, a technical or business degree is required.

SOFTWARE SUPPORT SPECIALISTS—(B.S.E.E./M.B.A., B.S.E.E., M.S.E.E./M.B.A., M.S.E.E., B.S.—Physics/Math, B.S.—Computer Science)

Programmers located in Maynard and in our field offices to support customers and field engineers, assisting in the installation, use and modification of Digital supplied software.

FIELD SERVICE ENGINEERS—(A.S.E.E. or Equivalent)

Technical training plus one or more years of "hands on" maintenance experience with digital control processors and peripheral equipment as a digital data processing repairman or engineering technician. Will be responsible for the installation, preventive and corrective maintenance of our computer systems at customer locations. Two to four month training program on our computer systems and peripherals. Nationwide positions available.

SOFTWARE/HARDWARE INSTRUCTORS—(B.S.)

Software/Hardware instructors teach logic and operation of computers to employees and customers at our headquarters in Maynard, Massachusetts, or at one of our Regional Training Centers. Courses cover solid state theory computer operation, circuits, diagnostic programming, peripheral equipment and more. Should be articulate and experienced in electronics and have a digital computer background. Previous teaching experience required, preferably one or more years.

PROGRAMMERS—(B.S., M.S.—Computer Science B.S.E.E., B.S., M.S.—Math/Physics)

Work conducted in the Programming Group includes: Systems Programming—The development of programs to accompany Digital hardware when it is sold.

Applications Programming—The development of software to accompany a specific task.

Diagnostic Programming—Used to quickly find "bugs" in the hardware both on the production lines and in the field.

Maintenance Programming—Performs in-house customer support.

MARKETING SPECIALISTS—(B.S.E.E., M.S.E.E., M.B.A.)

Market Research, Advertising and Promotion, Sales Support.

MANUFACTURING—(B.S.I.E., M.B.A., B.S.B.A., B.S.M.E., M.S.M.E.)

Production Supervision, Production Control, Purchasing, Manufacturing Systems, Process Engineers, Production Engineers, Mechanical and Electro-Mechanical Design Engineers.

SYSTEMS ANALYSTS—(B.S.—Math, Business or Electronics

Capable of systems design, analysis and programming of systems in support of business.

BUSINESS PROGRAMMERS—(B.S.B.A.; Accounting major preferred)

Responsible for detailed systems design, coding, testing and implementation of financial and administrative systems under the direction of a senior systems analyst.

FINANCIAL ANALYSTS—(B.B.A./M.B.A.)

Develop and exercise financial planning and control.

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WACHUSETT TO BUY COMPUTER

The Wachusett Regional School Committee voted last night to buy a computer for the high school for the coming school year.

The vote came on a recommendation from the Computer Applications Advisory Committee (CAAC). The advisory committee recommended the region buy a Digital Equipment Corporation PDP 11/40 at an estimated cost of $74,282.

Errol E. Ethier, educational data processing coordinator at the high school and a member CAAC will decide financing.

The computer, Ethier said, will be used for both teaching and administrative work.

Since starting the program in 1968, the school has rented computer equipment and time from Worcester Polytechnic Institute.

Benefits
Ethier said the CAAC asked for the computer because it would:

Stabilize the cost of the program.

Enable the region to individualize the computer's programs.

Increase the number of uses for teaching and administration.

Computers were introduced at Wachusett under a pilot project in 1968. About 25 students participated in an after-school course. The pilot project was continued the next school year with about 15 students taking a programming course during an activity period.

In 1970, the program was opened up to all students. About 100 took regular computer courses while another 50 used the computer in connection with science, business and math courses.

Last year, the enrollment in regular computer courses swelled to about 225 while the number using the computer in relation with other courses increased to about 250.

Ethier also said that 35 of the school's staff completed a course in how to use the computer in their courses. Because of the growing demand for computer courses, an independent study course, Computer Programming III, has been added this year.

(Reprinted from the Gazette,
Worcester, Mass. 8/29/72.)

DIGITAL REPORTS RESULTS FOR FISCAL '72

Digital recently reported sales and earnings results for its fiscal year which ended July 1, 1972.

Increased sales of $187,553,000 were reported for fiscal 1972, compared to $146,849,000 a year ago, an increase of $40,704,000 or 28 percent. Net income for the year amounted to $15,300,000 versus $10,600,000 in fiscal 1971. This represents a 44 percent increase in earnings. On a per share basis, $1.49 was earned in fiscal 1972 compared to $1.06 per share last year. Earnings per share were calculated on the basis of an average number of common shares outstanding, which in fiscal 1972 totaled 10,282,319 shares versus 10,043,923 a year ago.

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________	NEW! EduSystem 25 Brochure	Free!	
________	NEW! Huntington II Brochure	Free!	
________	NEW! "Digital Equipment's Puritan Profit," Reprint from "Management Today" Magazine	Free!	
________	NEW! BASIC-PLUS Language Manual System	7.00	________
________	NEW! RSTS System User's Guide	7.00	________
________	RSTS System Manager's Guide (For Valid System Managers Only!)	7.50	________
________	RSTS-11 Brochure	Free!	
________	Computer Lab Workbook	1.00	________
________	Computer Lab Teacher's Guide	5.00	________
________	Digital Control Handbook	1.00	________
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________	Introduction to Programming	2.00	________
________	Programming Languages	2.00	________
________	Logic Handbook	1.00	________
________	GT40 System; with 4K memory*	10,900.00	________
________	PDP-11 Remote Batch Terminal, less printer*	21,570.00	________
________	TSS/8 System for 16 users, less terminals and interfaces*	53,350.00	________
		TOTAL ORDER	________

Check Enclosed ☐ Bill Me Later ☐

* Includes appropriate manuals FREE! Also, lease plan available for these items.

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PDP-11/10

INSTANT DELIVERY! HUNDREDS ON THE SHELF!

DESCRIPTION

The economy computer, like the economy car, is usually cheap because it's stripped down; by the time the necessary options are added, price can double.

Although PDP-11/10 is economical in price, it is not one of these stripped down models. It is a full fledged PDP-11 family member—designed around the flexible UNIBUS™ structure—with the same instruction set and byte word addressing structure as the popular PDP-11/20. Included are such standard features as a teletypewriter interface, 8 general registers, hardware stacks, a hardware interrupt system with direct vectors for fast interrupt handling.

The system also includes a real-time clock and power fail protection and automatic restart—features which are extremely valuable in industrial and laboratory applications.

The economy of the PDP-11/10 is due to a totally new packaging design. The basic processor with 8K words of memory is only 5-1/4 inches high and will fit unobtrusively almost anywhere: underneath a terminal, inside control machinery, in a desk drawer, or in a suitcase.

Unlike other systems, however, the system's small size and low cost do not preclude its expansion. The system can expand to include up to 28K words of memory, a large number of peripherals, including disk, and is completely compatible with larger PDP-11 family members. For example, programs written on the PDP-11/20 can run on the PDP-11/10 wtih no modifications. And if and when upgrading is necessary, a larger PDP-11 can replace the PDP-11/10 with plug-in ease.

The PDP-11/10 is ideal for applications with limited storage or I/O requirements or for such dedicated applications as communications front end processing or a timesharing terminal controller. These applications may be in conjunction with a larger PDP-11 or with another larger processor such as the DECsystem-10.

In short, the PDP-11/10 is a powerful, economical and compatible processor. For the cost conscious user, it represents the most cost effective system available today...one which can be easily upgraded if the need ever arises.

™ Registered trademark of Digital Equipment Corporation

8K PDP-11/10 EDUCATIONAL SOFTWARE

BASIC

Dartmouth compatible BASIC with extras! String functions, optional LET, input/output files, immediate mode commands, and multiple statements per line.

FOCAL

An extended version of the FOCAL you know from the PDP-8 machines! It features recursive subroutine calls, double subscripted variables, and much more.

RSX-11A

A small real-time multiprogramming operating system for the PDP-11. It's designed for the customer who has to control a wide variety of real-time tasks but wants to start with a minimum of cost. (Tasks are machine language programs.) Via the monitor, tasks can be scheduled on a priority and time basis.

The system can support both core-resident and disk-resident tasks.

Starter system: 8K PDP-11/10 with Teletype, as offered here, plus a KW11-L clock. It can be expanded to include disk drives, high-speed paper tape, and analog/digital I/O.

Easy to use!

PDP-11 VERSUS CONVENTIONAL MACHINES

FEATURES	PDP-11	CONVENTIONAL
BUS	Single asynchronous bus, the UNIBUS, means greater system efficiency, easier interfacing and expansion.	Two or more synchronous buses, separate for I/O and memory.
PERIPHERALS	DIGITAL is a single source for processors, memory, peripherals. More choices, better reliability, quantity discounts.	Most companies manufacture mainframes only. Choice of peripherals is frequently limited.
VECTORED INTERRUPTS	Standard feature. Each device provides a direct vector to its own service routine. Automatically handled by hardware.	Software polling of I/O devices usually required.
DIRECT MEMORY ACCESS	Standard on all PDP-11's. Transfer rate: 5 million bytes per second.	Sometimes available as a costly option. Usually requires a separate DMA channel for each device.
POWER FAIL	Standard. Guarantees program and equipment protection and automatic restart.	Usually extra cost option. Typically guarantees memory contents, nothing else.
BYTE HANDLING	Can operate on bits, bytes, words or multiwords. 17 basic bytes instructions. All instructions operate on registers, memory locations or peripheral device.	Usually operates on single words—limited or no byte handling capability. Arithmetic instructions usually operate on accumulators only.
I/O INSTRUCTIONS	No I/O instructions needed. All instructions operate on device registers. Simplifies programming.	Separate I/O instructions required for data transfers. Complicates and limits programming.
HARDWARE STACKS	Standard hardware features on all models. Provides automatic temporary data storage. Improves efficiency, reduces programming costs.	Not normally available. Must be implemented by software at the expense of programming time, core memory space, and execution speed.
REGISTERS	Eight general purpose registers. No special accumulators required. Registers may be used as accumulators, index registers or pointers.	Usually one or two index registers or one or two accumulators. Complicated register/accumulator schemes.
HARDWARE INTERRUPT SYSTEM	Four levels allow multiple devices on each line.	Usually one level only with limited number of devices.
MEMORY	Memories of various speeds may be intermixed due to the system's asynchronous bus.	Machines that operate synchronously are restricted to a single memory speed.

ORDER FORM

Quantity	**Item**	**Unit Price**	**Total**
________	PDP-11/10, 8K core memory (60 Hz, 120 V only)	$6,995	$ ________
________	LT33-DC Teletype (60 Hz, 120 V only)	$1,620	$ ________
	(Lease plan available)	Total	$ ________
	(DEC will add tax and shipping charges FOB Maynard)		

Ship to: ________________

Bill to: ________________

1. Offer good only while supply lasts.
2. 30-day delivery applies **only** to 8K PDP-11/10 processor and Teletype; other peripherals, add-ons, etc. may be ordered for standard delivery.

Mail Order Form to:

Education Products Group, 5-5
Digital Equipment Corporation
146 Main Street
Maynard, Massachusetts 01754